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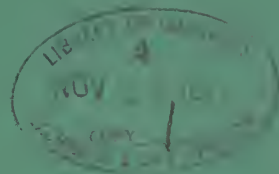




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Quarrying Near Urban Areas: An Aid to Premine Planning

**By J. M. Pugliese, D. E. Swanson, W. H. Engelmann,
and T. R. Bur**



UNITED STATES DEPARTMENT OF THE INTERIOR

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UNITED STATES DEPARTMENT OF THE INTERIOR
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U.S. BUREAU OF MINES

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QUARRYING NEAR URBAN AREAS: AN AID TO PREMINE PLANNING

by

J. M. Pugliese,¹ D. E. Swanson,² W. H. Engelmann,³ and T. R. Bur⁴

ABSTRACT

The Bureau of Mines, in support of its overall goal of helping to meet future U.S. demand for minerals, undertook this study to aid the quarry entrepreneur and/or operator in developing quarries near urban areas. In response to increased environmental concerns, the quarry operator often must take steps beyond those required in the last decade toward gaining permits for quarrying near metropolitan areas. Following the steps suggested in this report should increase the chances to obtain the permits to open and develop a quarry. Each task and question in the general plan flow diagrams are described in detail, with the flow diagrams aimed at the goal of acquiring the necessary permits. The appendixes include (1) types of projects for which Environmental Impact Statements (EIS's) may be prepared and Federal agencies responsible for preparing them, (2) State contacts for information regarding environmental impact assessment requirements and mining and mineral land reclamation laws, (3) a checklist of environmental inventory factors, (4) a tabulation of different regulations that affect mining in Michigan and the number of townships and counties that have each of the listed regulations, and (5) environmental logic associated with site selection.

A central recommendation is that the quarry entrepreneur and/or operator coordinate plans at the beginning with local government officials (such as township supervisors and/or city and county planning board members), State and Federal officials, and public groups that will be affected.

INTRODUCTION

The Bureau of Mines has developed this report to help the quarry entrepreneur and/or operator avoid unnecessary delays in gains permits for proposed operations near metropolitan centers. The reported general plan is an attempt

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to integrate necessary tasks in the premine planning process for quarry development near an urban area. The premine planning process begins when a site is considered for quarrying and ends when the final permits are obtained. In this report, an operator is defined as one: (1) of little experience in environmental matters pertaining to mining, and (2) operating with limited capital, perhaps from only a single funding base.

Before a quarrying permit can be issued, many procedural requirements must be satisfied including new ones concerning the environmental. The operator may not be able to cope easily with the new requirements.

Although previous work in the area of general premine planning for quarrying near an urban area is not extensive, the following work is reported as background information and as input that led to the present research.

Evans (6)⁵ stated in a California metropolitan study that, during the last decade, mining of sand and gravel has increased markedly because of metropolitan growth. With these urban centers expanding to meet and even surround once-remote quarries, the need for land-use planning has become acute, especially at the local governmental levels. Dames and Moore prepared a three-volume report (4) on premine and reclamation planning as applied to surface coal mining. A 1972 study by Landerman and Schwartz (11) on the development and rehabilitation of sand and gravel areas in southern California analyzed the lands as a natural resource considering public concern for a cleaner environment. In 1963, Schellie and Rogier presented a guide (19) for successfully reclaiming land after the extraction of sand and gravel; it was intended to inform the aggregate producer of how to use the land soundly and how to evaluate hired professional consultants. The guide focuses on site choice, reclamation improvement, and the landscape architecture.

French (8) investigated the social and economic results of surface mining operations near Atlanta, Ga. However, this work predates the environmental concerns of this decade and, as the authors noted, it treats only one case and is, therefore, not expected to produce final or nationwide answers. The Burris Sand Pit (Calif.) evaluation (23) and the South Boulder Creek (Colo.) Environmental Impact Assessment (7) are oriented toward particular locations and environments.

An interesting concept of State Government aid to an entrepreneur in the planning stage is exemplified by Minnesota's Environmental Permit Coordination Unit under the State Planning Agency. The unit's assistance involves (1) identifying all required permits before the project is implemented; (2) providing a single hearing on appropriate permit applications; (3) providing time frames for making agency decisions; and (4) providing to the applicant statements of reasons if permits are denied.

In preparing this report as an aid to the operator planning an aggregate operation near an urban area, information was obtained nationwide as well as

⁵Underlined numbers in parentheses refer to items in the list of references preceding the appendixes.

from the aforementioned sources. Four large Standard Metro Statistical Areas (SMSA) (15)--Detroit, Los Angeles, Minneapolis-St. Paul, and Pittsburgh--were investigated further for additional data to test the general plan. The present report stresses the importance of cooperation with local governments, as well as with State and Federal Governments; urges that reclamation and environmental impact rationale be included from the earliest stages of mine planning; and gives a logical plan aimed at acquisition of operating permits.

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The authors wish to thank the late Fern L. Krech, physical science technician, Twin Cities (Minn.) Mining Research Center, for obtaining data from the Minneapolis-St. Paul, Minn., area. The authors also thank the Bureau of Mines Liaison Officers, W. H. Kerns, E. C. Peterson, R. C. Briggs, and W. Kebblish, for their input from California, Michigan, Minnesota, and Pennsylvania, respectively. Professor R. E. Yarbrough, Southern Illinois University, Edwardsville, Ill., made valuable suggestions in the early phase of this study.

GENERAL PLAN

Generalized, premine objectives for quarrying near an urban area must meet ordinance and environmental requirements with a minimum of cost, time delay, and adverse citizen pressure. Figures 1-6 shows a progression of efforts from initial project and site consideration to the final permit effort. To better explain these figures, tasks (lettered) are discussed under questions (numbered).

The following questions are covered: (1) Is amount and source of capital available to put the project into operation? (2) Is the business and public climate favorable for quarrying in this area? (3) Will the regulatory agencies invoke the Environmental Impact Statement (EIS) process? (4) Is the detailed data collection program acceptable? (5) Should the detailed data collection program be revised? (6) Are there large, unavoidable environmental impacts that may stop authorization? (7) Should permits be obtained?

In the figures, when data up to a certain point show that an area precludes operation, a "stop action" instruction urges consideration of alternative land uses or aborting the effort. In response to a "stop action," other possible quarry sites may be sought, and some data already collected may be used.

Question 1.--Is Amount and Source of Capital Available To Put the Project Into Operation (fig. 1)?

Task A.--Initial Project and Site Consideration

At this time, the proposed project may be little more than one individual's idea. This task is an office effort, a brainstorming meeting, and should be conducted as an in-house effort. This task should not be performed without those who will be the financial partners in the endeavor and may be

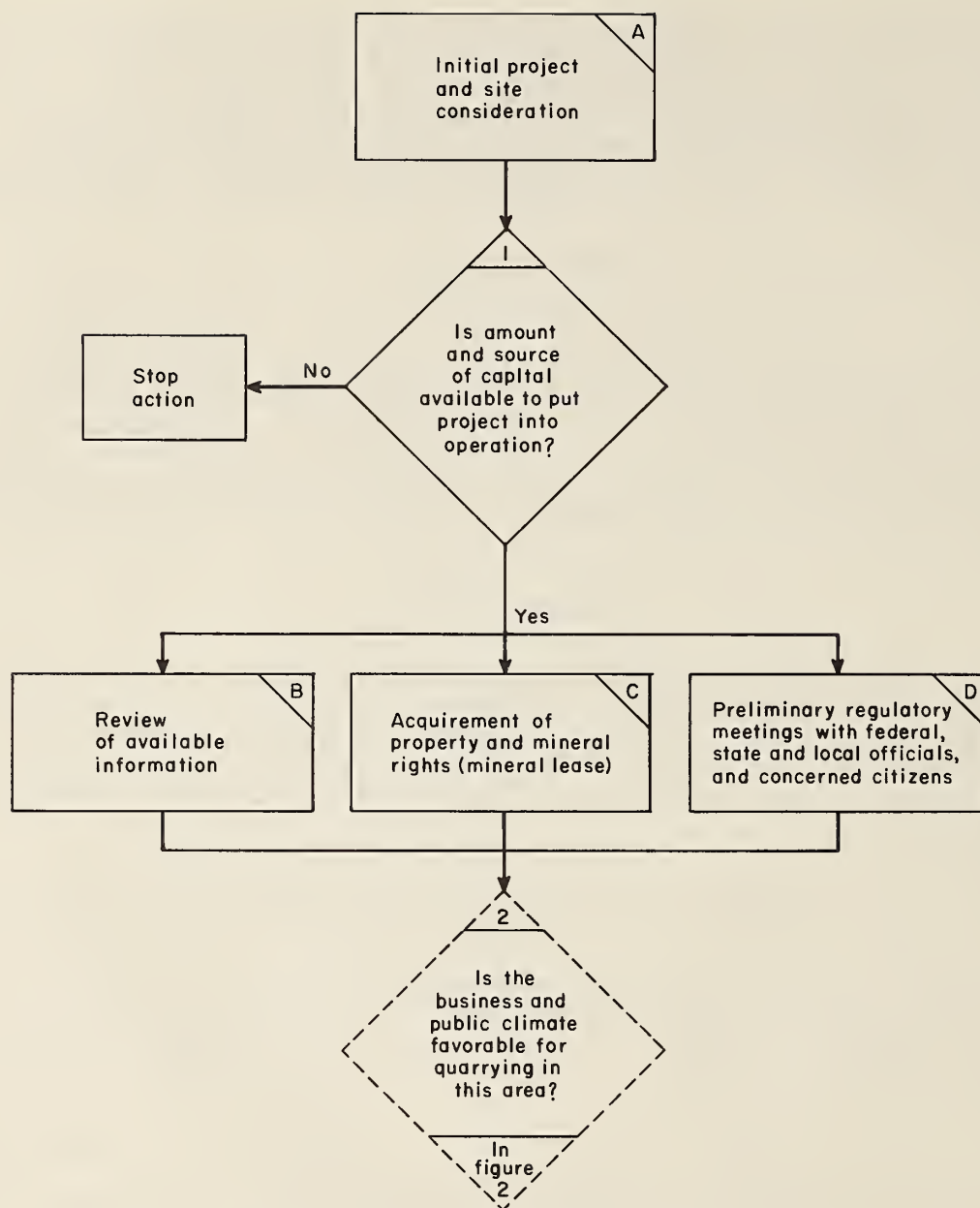


FIGURE 1. - Question 1: Is amount and source of capital available to put the project into operation?

facilitated by consultants who have been successful recently in securing permits or in planning related operations.

At this time, consider the following:

1. General quarry objectives and procedures.
2. Economics of present mineral market and its outlook.

3. Cost of data for environmental assessment possibly required by State, Federal, or local regulatory agencies.
4. Bond requirements and permits needed.
5. Nature of site (physical character and present use in relation to area).
6. Source and amount of capital needed to put plans into operation.
7. Ability to acquire property and mineral rights (rate of rise of land values and present owner's possible intended use).
8. Previous industrial experience in the area.
9. Project alternatives (adjacent or nearby sites equally promising or better?).
10. Local zoning ordinances.

After completion of task A, question 1 is asked. This question addresses several topics--amount of capital available, predicted cost of project, possible costs which may arise, project feasibility, and risk of investment. If the answer is yes, proceed to task B. If the answer is no, stop action.

Task B.--Review of Available Information

There are geological, environmental, political, social, and economic considerations that must be investigated in more detail. The following list is included as a general aid for review of available information, based upon case histories and the authors's findings. The list's numbering sequence does not reflect priority. In regard to item 1, the operator should first determine which agencies must be contacted for obtaining permits and licenses for the proposed operation.

1. Contact the U.S. Environmental Protection Agency (EPA), the State's department of natural resources, the State's environmental quality council or equivalent, the State planning agency, and local zoning authorities. Many of these agencies have local representatives; the county or township officials may be of help in locating them. If regulatory officials are made aware of the proposed venture and are asked to comment, the probability of their intervention at later, unexpected times is reduced.

2. Review for the particular area appendixes A through D. These appendixes provide information concerning (a) types of projects for which EIS's may be needed and Federal agencies responsible for preparing them; (b) State contacts for information regarding environmental impact assessment requirements, and mining and mineral land reclamation laws, (c) environmental inventory factors, and (d) excerpts from reference 13 concerning effect of local zoning ordinances on mining in Michigan, as an example of zoning ordinances as a primary tool to regulate mining operations.

3. Determine which laws and regulations apply to the mine site and activity. The Environmental Reporter and the Federal Register⁶ are good sources of such information.

4. Check classified telephone directories for listings of local environmental groups who may be very influential in your community; they should be considered early.

5. Review local newspapers to assess local developmental or planning concerns. Such information may prove helpful in anticipating legislation and in reclamation planning.

6. Review base topographical maps. Obtain these from the U.S. Geological Survey, State geological survey, and/or the county seat offices. Maps which show streets, buildings, landmarks and points of interest, vegetation, surface water, and topography should be reviewed.

7. Obtain names and location of local government officials who will review the project and grant permits. Pamphlets, like that of the Westmoreland County, Pa., Association of Township Officials (25), that provide this information usually are available at the county or township office. The importance of this effort is amplified by Middlewood (13). Her results suggest that the zoning ordinance is a primary tool to regulate mining operations, including the removal of sand and gravel. Excerpts from this reference are found in appendix D; local ordinances are on file at the Bureau of Mines Twin Cities Mining Research Center. The operator's knowledge of local ordinances that pertain to the site of planned operation is emphatically important.

8. Contact the State Liaison Officer of the U.S. Bureau of Mines for case-history information, official contacts, and opinions concerning the mining proposal.

9. Take photographs of the specific site and surrounding area where the quarry operation is proposed. Reclamation procedures upon completion of quarry operations should restore the land to at least the quality of the premine environment.

10. Construct a reduced matrix to evaluate environmental impact. See Leopold (12) for complete procedural instructions and a very detailed matrix model and appendix E for an example of a reduced matrix.

11. Consider alternatives to the proposed action that may decrease negative environmental impacts while retaining feasibility of the initial idea.

12. Apply environmental logic to the site selection effort. Appendix F should help.

⁶The Environmental Report is published on a weekly basis by the Bureau of National Affairs, Inc., Washington, D.C. The Federal Register is published daily, Monday-Friday, by the National Archives and Records Service, General Services Administration, Washington, D.C.

Task C.--Acquirement of Property and Mineral Rights (Mineral Lease)

Begin prospecting and exploration efforts. For example--

1. Determine exploration requirements.
2. Lease property for exploration. It is important that term of lease be long enough to allow exploration, but the entrepreneur should strive for the option of release if the deposit does not warrant development.
3. Obtain prospecting or exploration permits if necessary.
4. Obtain physical samples required to give a cursory but accurate assessment of important geologic parameters.
5. Assess important geologic parameters. Accurate geological data must be acquired to make a comprehensive decision on determining project feasibility and acquiring property and mineral rights.

When acquiring property and mineral rights, purchase of property adjacent to that to be used for quarrying may be advisable. This adjacent property could serve as a buffer.

Barrows, Ostrom, and Preston (1) note that the option to buy often joins a mining lease but may be a separate agreement which has many of the same provisions as a mining lease. A landowner may not wish to sell property if royalties paid on leases would approach or exceed the land's market price. A lease containing an option to buy should be investigated thoroughly soon after the lease agreement.

Leases should specify the following:

1. Tract of land involved.
2. Manner of mining.
3. Rights of access.
4. Liability and responsibility for damage or injury.
5. Provisions for land reclamation after completion of mining activities.
6. Inspections.
7. Taxes.
8. Royalties.
9. Termination date.
10. A legally acceptable means of settling disputes.

Royalties vary; they depend upon several factors such as the quality of the deposit, distance from markets, and the negotiation skills of the landowner. The landowner may demand an annual or monthly guarantee of payments, restrict interference with nearby land, or sell the property and wish to retain the title to minerals. The effects of inflation should be considered when negotiating prices or payments.

Task D.--Preliminary Regulatory Meetings With Federal, State,
and Local Officials, and Concerned Citizens

Assess the social and political opinions concerning the proposed project through meetings with those who are intimately aware of or will be intimately involved with the permitting process. Be aware of others who may later be involved in the premining and mining effort.

In regard to pollution control, regulatory officials may be following a logic similar to that in appendix G. The path of least resistance is traveled when citizen complaints and legal actions are minimized. It is important that social and political concerns be known at an early time; preliminary meetings will help in this assessment.

The following suggestions should be considered in the planning of meetings and the assessment of opinions:

1. Invite township supervisors, county planning officials, and local authorities.
2. Invite officials of EPA and the State department of natural resources serving the area.
3. Invite representatives from local environmental groups that may later voice interest in the mining proposal.
4. Invite concerned citizens, especially residents and owners of property near the proposed mine site.
5. Provide raw data for review at the meetings.
6. Determine what must be measured in the matters of air and water quality, waste and noise levels, and ground vibrations from blasting.
7. Exhibit land-use plans, with special emphasis given to the local benefits from the operation, the completeness of the reclamation plan, and the steps planned for minimizing negative environmental impact during operation and site reclamation activity.
8. Above all, be honest in representing the proposal's intent. Well-planned, conscientious proposals should welcome constructive criticism. Citizen opposition and regulatory control do not end with permit approval; they may be as effective in preventing mine operation after permit acquisition as they are before.

9. Determine if an Environmental Assessment (EA) or an EA-EIS might be prepared by regulatory agencies. Estimate what the decision threshold might be, above which the EIS process is triggered. For this report, "categorical exclusions" will not be considered in the EIS process.

Separate discussions with proposed aggregate purchasers may also be planned as part of task D.

Question 2.--Are the Business and Public Climates Favorable
for Quarrying in This Area (fig. 2)

Based upon preliminary information gathered, decide whether the social, political, and business climates, as well as their anticipated responses to the operation's level of environmental impact, favor quarrying in this area. If these climates are unfavorable, stop action. At this point, little effort and capital have been invested in the total endeavor, and the search for an alternative quarry site may be easily continued elsewhere. If conditions for quarrying appear favorable, proceed to tasks E and F.

Task E.--Environmental Impact Update

Update background on the environmental impact of the proposed operation, based on the results of tasks A-D; specifically--

1. Alter the reduced matrix in response to the preliminary meetings.
2. Determine the aspects of the operation which are most environmentally controversial.
3. Determine, from earlier discussions with regulatory officials, the criteria that must be met to satisfy permit application procedures.
4. Modify the project idea, if possible, to reduce adverse impacts and to comply with regulatory requirements.
5. Determine a monitoring or impact-testing program that satisfies permit requirements and budget restrictions. Professional consultation is advisable in this matter; impact assessment experts may already be on the premine planning team (task A) or may be hired.

Task F.--General Public Relations Effort (Part 1)

At this time, the proposed project should become public knowledge to decrease the probability of later delays and complications resulting from the pressures of unforeseen public opposition. At this point, local regulatory officials and concerned citizens residing near the proposed site will already know of the proposal to mine. Consider releasing news of the pending operation to local newspapers. Public hearings called by local authorities provide an excellent opportunity to further assess public opinion and to inform the public of matters concerning the proposal.

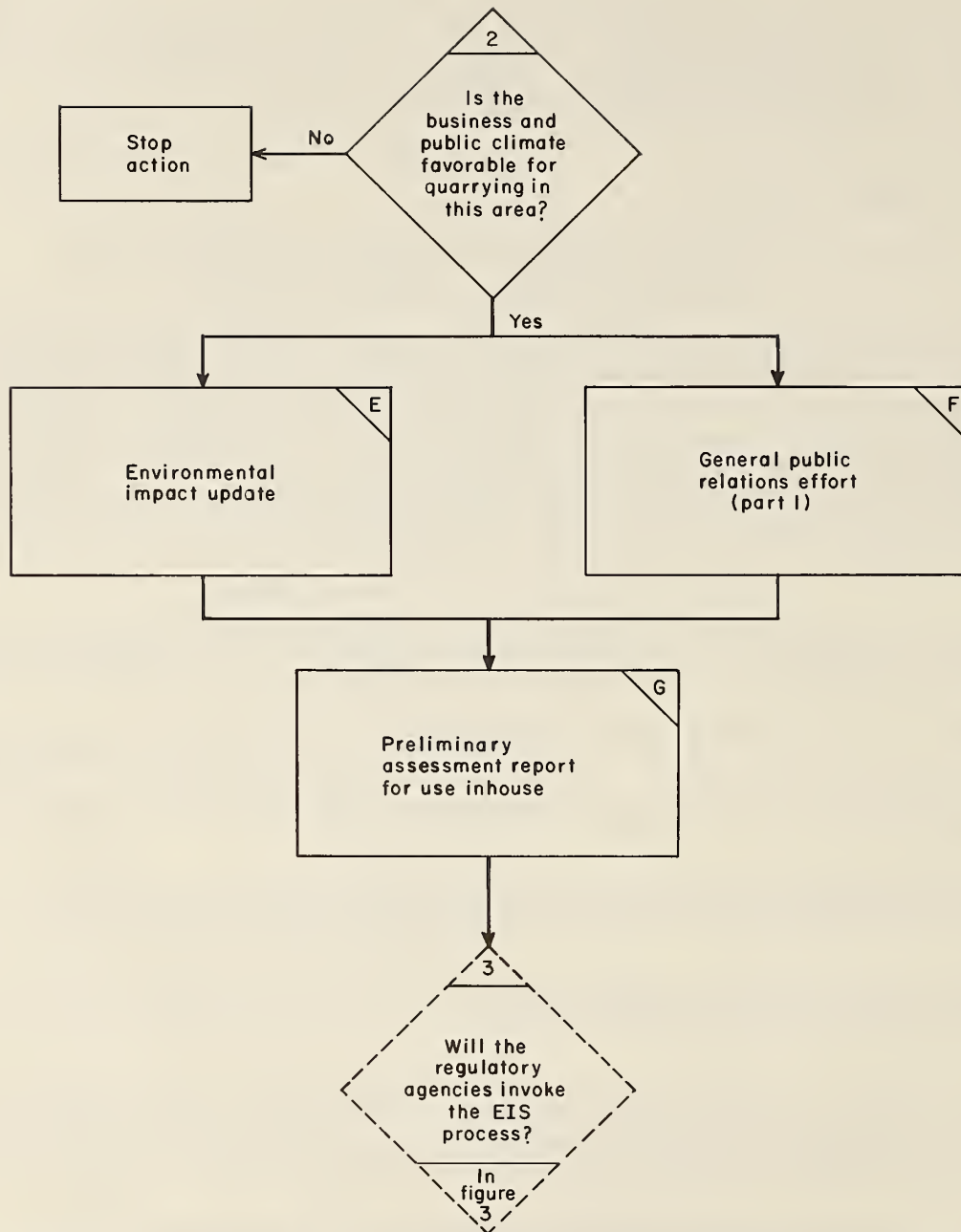


FIGURE 2. - Question 2: Are the business and public climates favorable for quarrying in this area?

The importance of an image-improvement policy is noted in Bauer's article (2) about mining in an increasingly urban environment. In the article, he notes that the focus of the presentation is environmental quality, but another real issue is a good neighbor policy.

This effort may continue and expand into task H (fig. 3).

Task G.--Preliminary Assessment Report for Use In-House

A preliminary assessment report serves as a reference for future efforts. It comprises a comprehensive file on the activity to this point. The following information might be included in the preliminary assessment report:

1. Site description.
 - a. Location and legal description.
 - b. Topography and climate.
 - c. History and present use (zoning).
 - d. Present owner's property rights.
2. Site geology.
 - a. Stratigraphy.
 - b. Structural geology.
 - c. Economic geology.
 - d. Resource estimation.
3. Developmental economics.
 - a. Market potential.
 - b. Ownership or lease.
 - c. Royalties and/or taxes.
 - d. Production prerequisites.
 - e. Inflation projections.
 - f. Investment comparison with low-risk investments.
 - g. Amount and source of available capital.
4. Equipment and labor needs.
 - a. Blasthole drills.
 - b. Blasting materials.
 - c. Dozers, scrapers, front-end loaders, shovels.
 - d. Conveyor systems, trucks.

- e. Site-specific equipment.
 - f. Road-maintenance graders.
 - g. Compactors.
 - h. Hydroseeders.
5. Proposed project-planning statements.
- a. Land-use plan.
 - b. Mining plan.
 - c. Reclamation plan.
6. Political conditions.
- a. Permits.
 - b. Bonds.
 - c. Environmental assessment requirements.
 - d. Possible delays.
7. Environmental conditions.
- a. Impacts (beneficial and adverse).
 - b. Adverse impact abatement.
 - c. Operational restrictions.

In a report by the U.S. Bureau of Outdoor Recreation (21), the American Aggregates Corporation suggests the following ways to minimize undesirable impacts and to maximize the site's potential for productive end uses; these may be included as proposals in the preliminary assessment report.

1. Locate the main plant, stockpiles, loading facilities, and access routes as far as possible from adjacent property owners.

2. Use natural screens such as hills, trees, and remoteness to isolate the operation.

3. Construct attractive safety fences around the operation's perimeter and plant hedges to improve aesthetic impact.

4. Stockpile and grade overburden storage piles around the perimeter of the most active locations of operation to create sight and sound barriers; these stockpiles may be vegetated to increase the quarry's attractiveness.

5. Plant trees around the main plant area.
6. Construct a solid, dust-free, entrance driveway with gate enclosures.
7. Erect modest but attractive office buildings and weigh stations.
8. For the shallow quarry, consider backfilling the excavation face with overburden to create gently sloping banks; cover with topsoil, grade smooth, and do final landscaping and seeding while the excavation progresses.

The above suggestions are exemplified in environmental planning reports (5); similar suggestions are found in the Environmental Impact Statement for a proposed copper mine in Wisconsin (20). According to the U.S. Bureau of Outdoor Recreation (21), the absence of preplanning frequently results in a mined area where topographic and vegetative characteristics are poorly suited for long-term land usage and whose reclamation may involve excessive costs and manpower.

Reports (16-17) may be reviewed for information on quarry planning and blast pattern design with respect to the geologic structure of the area.

Question 3.--Will the Regulatory Agencies Invoke the Environmental Impact Statement (EIS) Process (fig. 3)?

The EIS process has been considered above in the project feasibility efforts. Find out if regulatory agencies will prepare "full blown" EIS's on the proposed effort. Each agency and its officer responsible for preparing the EIS must be identified. A yes response to the question could trigger a choice between stopping action or proceeding to tasks H and I.

Proceed to tasks H and N if the response is no. Compliance with a regulatory agency's request for information, including that of environmental assessment substance, may require certain efforts similar to those described below for the yes response, but probably to a lower degree.

Task H.--General Public Relations Effort (Part 2)

This effort may be thought of as a continuation and expansion of task F. The following suggestions should be helpful:

1. Have a local printer prepare a brochure containing facts about the mining operations such as mining and processing methods, pit dimensions, life of operation, work force requirements, service to the community, tax base support, and reclamation plans. The brochure should be written in layman's terms.
2. Have an open-door office policy for citizens to obtain brochures and to discuss any aspects of the operation proposal.
3. Construct displays depicting the planned operation and subsequent reclamation.

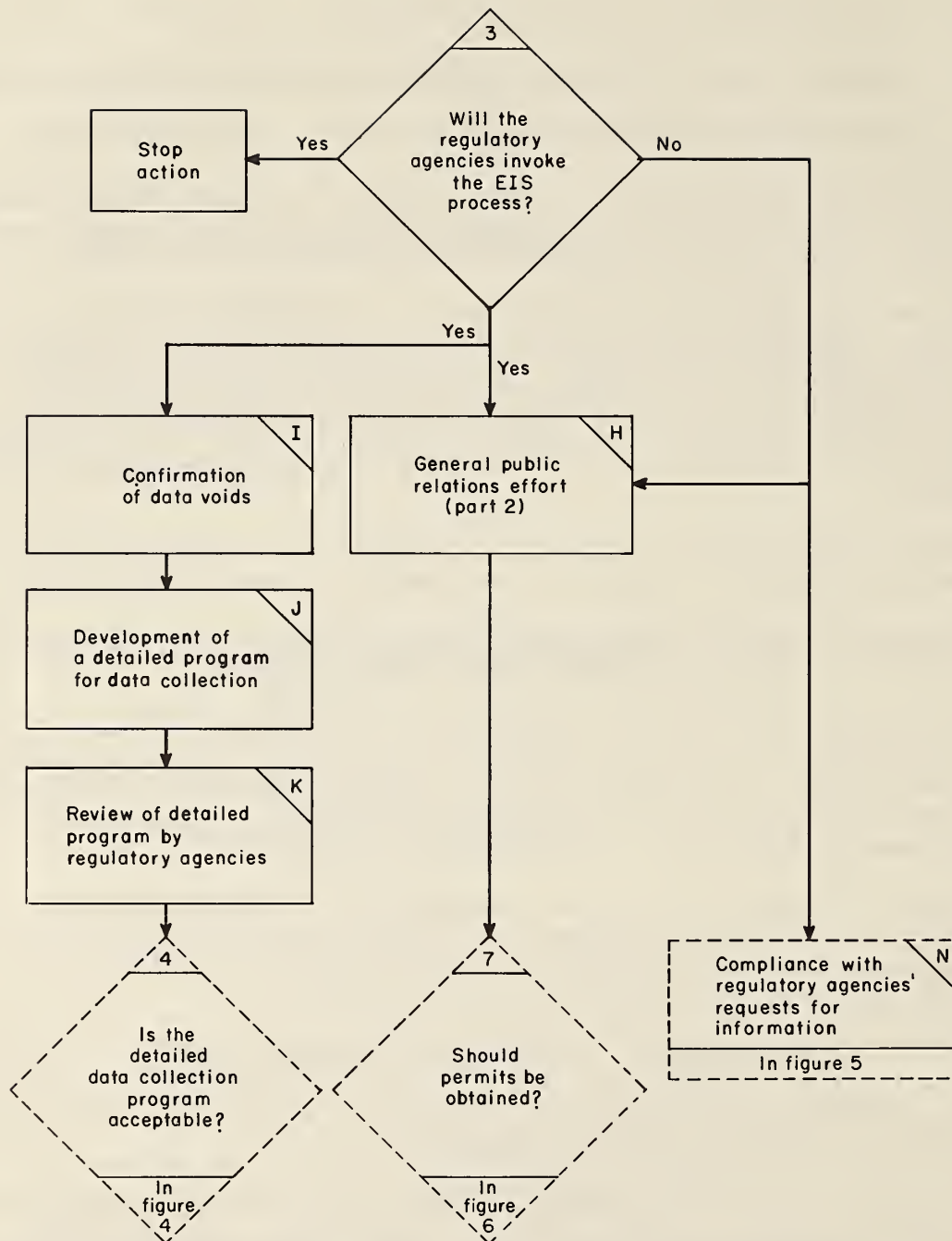


FIGURE 3. - Will the regulatory agencies invoke the Environmental Impact Statement (EIS) process?

4. Organize public meetings to discuss the proposed operation if citizen interest warrants such action.

5. Indicate to the general public how reclaimed land will beneficially fit into the area's general land-use scheme.

Task I.--Confirmation of Data Voids

Confirm the information voids from review of the preliminary assessment report (task G). The voids must be addressed before developing a detailed program for data collection (task J) and the actual data collection effort (task L).

Task J.--Development of a Detailed Program for Data Collection

A program for data collection aids in meeting the requirements of the National Environmental Policy Act of 1970 (NEPA), the State permit requirements, and the local ordinances. Local ordinances may use the same language as the Federal act.

Specific needs should be explained by specialists involved in studies necessary to make environmental impact decisions.

Statistical techniques may be helpful in analyzing data sets that have incomplete data points. Ranges of expected values for some parameters (derived from similar situations) can be expressed where measured values are available.

The following suggestions should be taken in the planning of environmental studies:

1. Conduct measurements in a manner acceptable to the permit-approving agencies who request impact data.
2. Describe the specifications of monitoring devices to be used.
3. Use equipment endorsed by the permit-reviewing agencies and organizations such as the American National Standards Institute.
4. Indicate sources of environmental impact on an operations map in relation to other undesirable impacts and site conditions.
5. If consultants are hired, contract them to tabulate data and complete the necessary paperwork for permit application.

Task K.--Review of Detailed Program by Regulatory Agencies

Organize a meeting for the review of the program for collecting EIS required information. Bring in the reviewers who attended the preliminary regulatory meetings (task D). These reviewers should, from previous discussions, be familiar with the initial proposal. Their opinions of the detailed plan are important and should be obtained in writing, if possible.

Conditions may change before permits are acquired and periodic review of the detailed program may be necessary.

Question 4.--Is the Detailed Data Collection Program Acceptable (fig. 4)?

The adequacy of the program is largely determined by the regulatory officials' opinions gathered during review meetings. The detailed program should satisfy permit requirements, resolve major engineering and environmental questions still unanswered, and yet remain within economic feasibility.

If the proposed data collection program is not acceptable, ask--

Question 5.--Should the Detailed Data Collection Program be Revised (fig. 4)?

If the answer is no, stop action. If yes, then redevelop the program (task J) and resubmit program to regulatory agencies for review (task K). Question 4 is then asked again.

When the answer to question 4 is yes, advance to task L.

Note that the general public relations effort (task H) continues parallel with efforts described in figure 4. Compliance with regulatory agency(s) requests for information will be discussed later.

Task L.--Data Collection, Analysis, and Interpretation

Collect data as described in the detailed data collection program. Analyze and interpret the results of the data collected.

Task M.--Evaluation of Environmental Impacts

Evaluate the assessed impacts of the proposed operation and alternatives. Incorporate desirable alternatives into the proposed operation plan.

Impact evaluation of the proposed operation should include discussions of the following:

1. Favorable effects.
2. Adverse effects.
 - a. Avoidable (eliminated or mitigated).
 - b. Unavoidable.
3. Long-term and short-term impacts.
4. Irretrievable and irreversible effects.

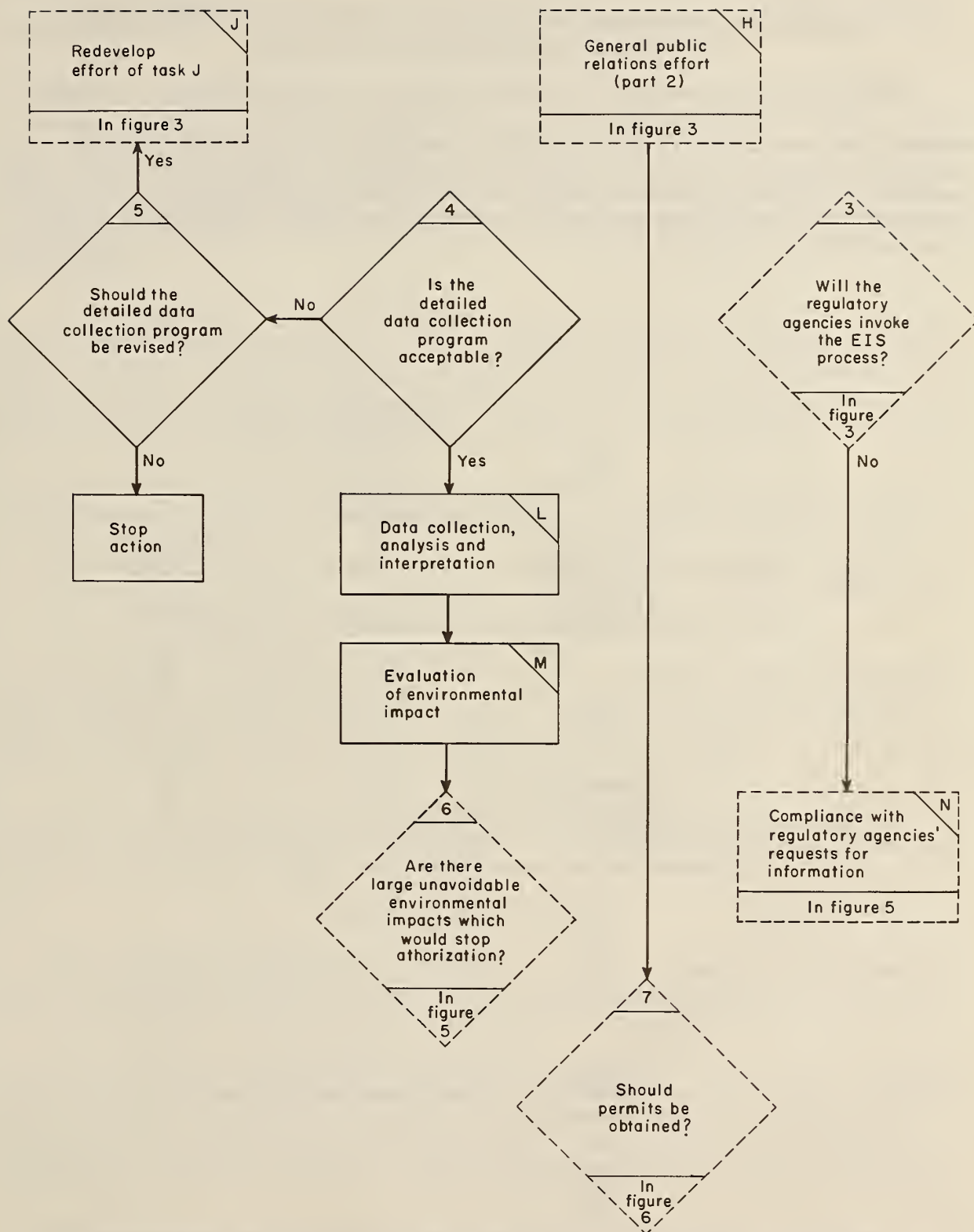


FIGURE 4. - Questions 4 and 5: Is the detailed data collection program acceptable? Should the detailed data collection program be revised?

Question 6.--Are There large, Unavoidable, Adverse Environmental Impacts That May Stop Authorization (fig. 5)?

This question is asked after evaluation of the data collected in tasks L and M. Much of these data would be of the baseline nature. Analysis would be made of the baseline data obtained by the operator, the data supplied by regulatory agencies, and data obtained from ongoing, similar operations. The question is important because large, adverse, unavoidable impacts may stop authorization; the impact evaluation (task M) and public opinion are indicators in making a decision here.

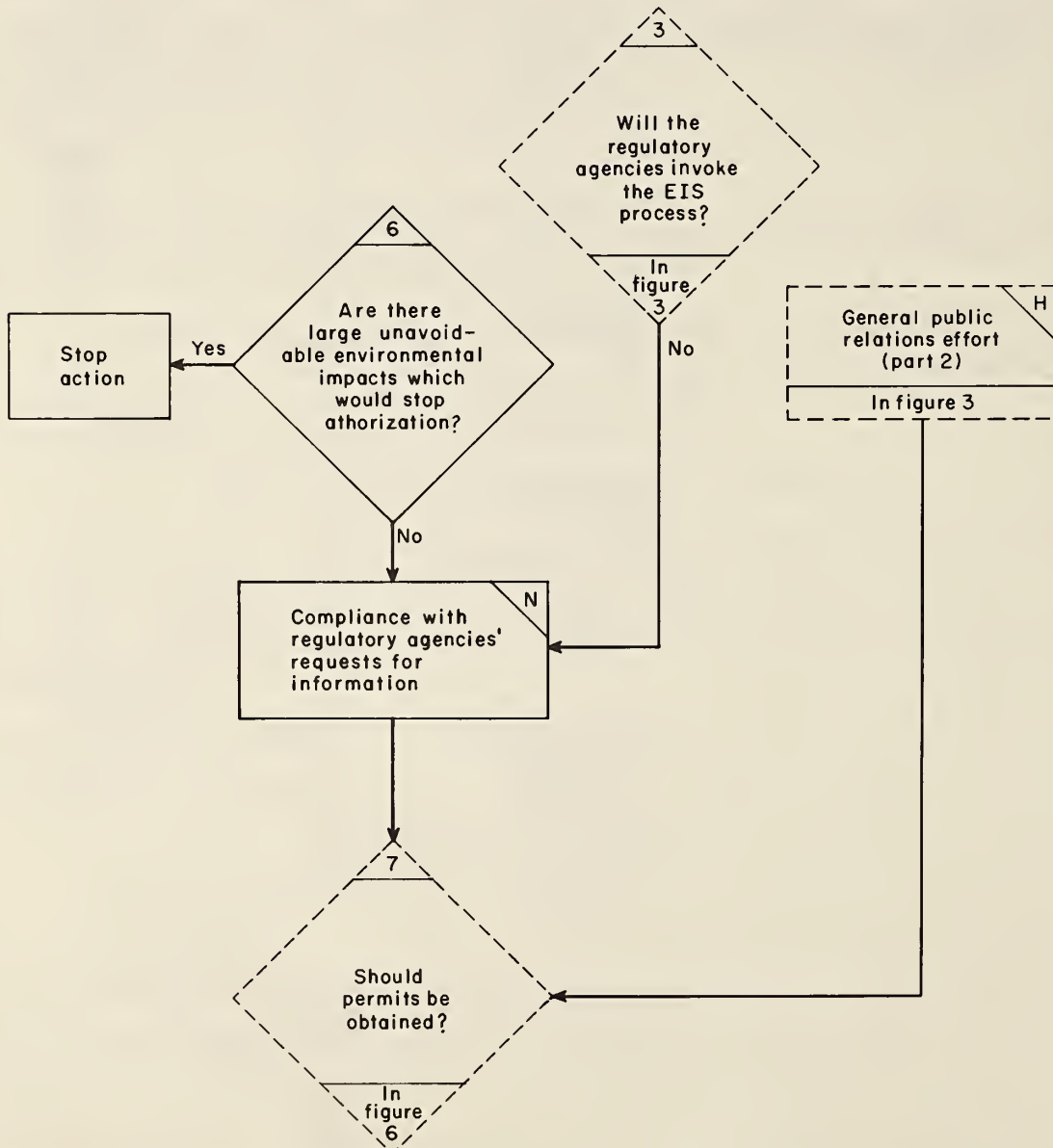


FIGURE 5. - Question 6: Are there large, unavoidable, adverse environmental impacts that may stop authorization?

If the answer to question 6 is yes, stop action. If no, proceed to task N.

Task N.--Compliance With Regulatory Agencies' Requests for Information

Prior discussions with regulatory officials should have indicated whether the proposal requires the furnishing of significant amounts of environmental data for the preparation of a formal EIS. If the answer to question 3 was no, then the information requested would pertain primarily to fulfilling permit requirements, although information may also be desired for environmental assessment.

EIS preparation is the responsibility of government regulators who control actions that pose significant environmental impact. In regard to agencies concerned with EA-EIS requirements, see appendix A for examples of Federal agencies and appendix B for examples of State agencies. Because these agencies cannot always fund all aspects of their own EIS preparation, the operator may have to furnish input at the operator's expense.

The EIS process can be quite time consuming. Steps performed by regulatory agencies in this task are exemplified in the handbook by Ross (18).

In figure 5, note that the public relations effort of task H continues.

Question 7.--Should Permits Be Obtained (fig. 6)?

This question requires a last look at all indicators before deciding to obtain permits. If all matters are in order and permit approval appears certain, advance to task O. However, if after completing all previous tasks acquisition of all needed permits seems remote because of last-minute developments, stop action.

If the yes decision is made, a public relations effort will still be needed in the mining phase. This study concerns only the premining phase and will conclude with the next task, that of obtaining permits.

Task O.--Obtain Permits

The necessary applications for permits should be completed and submitted to the appropriate agencies. Applications should be prepared by persons who have been successful in gaining permits in the immediate past.

The following lists gathered from State government reports (14, 20) show that permits may be required for a variety of operating conditions. Normally, State and local contacts are the best sources for information and permits. While these lists are meant to be inclusive, items are for reference and are not meant to guide the operator toward seeking permits in all the following categories:

From the State department of natural resources:

1. Structure and deposits in navigable waterways.

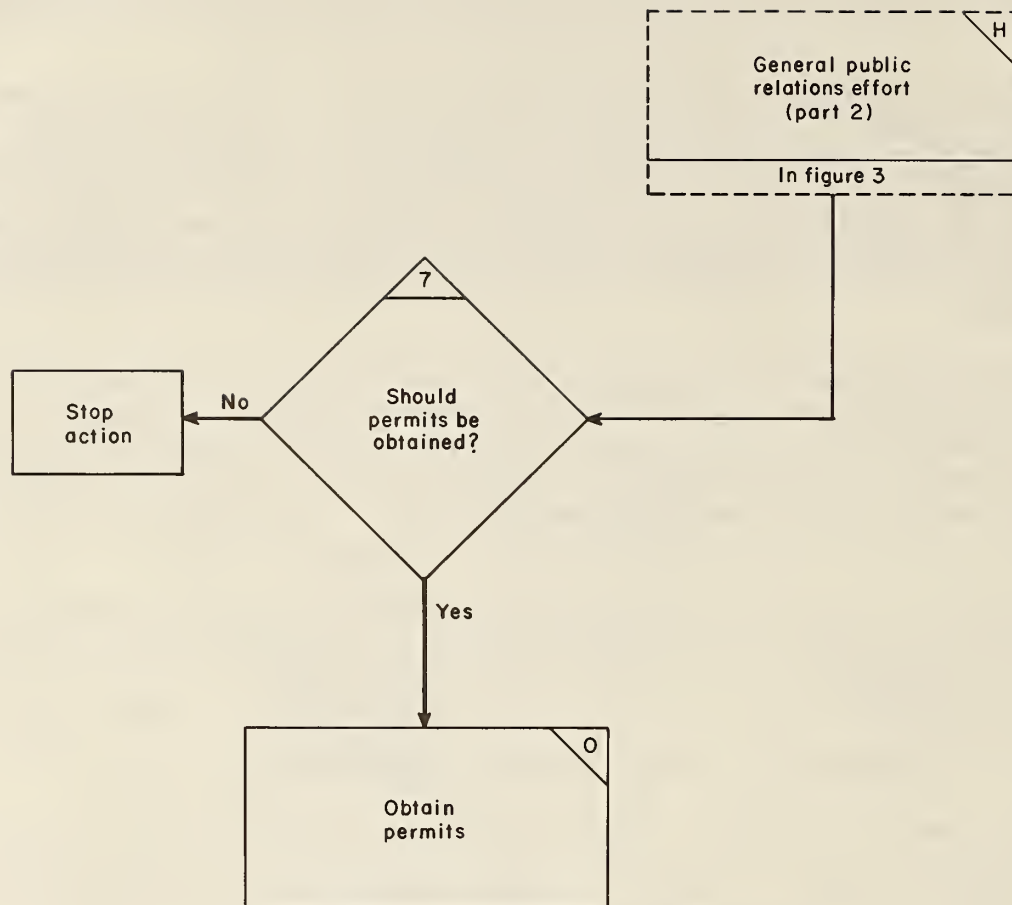


FIGURE 6. - Question 7: Should permits be obtained?

2. Diversion of water from lakes and streams.
3. Enlargement and protection of waterways.
4. Changing of stream courses.
5. Notice required for construction.
6. Solid-waste burial.
7. Prospecting.
8. Mining.
9. Pollution discharge elimination.
10. Surface-water appropriation.
11. Ground-water appropriation.

12. Work in beds of public water.
13. Utility crossing.
14. Zoning guidelines (land use).

From the State pollution control agency:

1. Liquid-waste disposal.
2. Compliance with water-quality standards.
3. Gaseous-waste disposal.
4. Solid-waste disposal.

From the State department of health:

1. Sewage disposal system.
2. Plumbing plans.
3. Potable water supply.
4. Water well construction.
5. Industrial waste disposal.
6. Occupational disease requirements.

From the State department of industry and labor, U.S. Occupational Safety and Health Administration, and U.S. Mine Safety and Health Administration:

1. Occupational health and safety.
2. Structures.
3. Equipment.
4. Facilities.

From the State department of transportation, U.S. Department of Transportation:

1. Highway access.
2. Utilities.

From the State fire marshall:

1. Building plans.
2. Storage of combustibles, explosives, and flammables.

From the U.S. Department of Agriculture, Forest Service:

1. Land use.
2. Timber management.

From the U.S. Army Corps of Engineers:

1. Deposit of fill materials on wetlands or navigable waterways.
2. Dredging.
3. Construction within jurisdiction of the Corps.

From local authorities:

1. Buildings.
2. Zoning.
3. Land use.
4. Burning.

SUMMARY

The presented flow diagrams, with associated text under "General Plan," comprise a good aid to premine planning for quarrying near a large urban area. The authors' findings suggest that following the flow diagrams, which incorporate the spirit of NEPA and its progeny, should result in more ready public acceptance of quarrying proposals and enhance the probability of obtaining the necessary permits to open a quarry near a metropolitan area.

Permit-seeking efforts should begin with local regulatory officials as well as with State and Federal officials. A description of the mining and environmental planning should also be presented to public groups that are affected by the proposed quarry. If the project proves to be too environmentally controversial, it may possibly be altered or suspended before committing a significant amount of capital. The presented systematic approach shows where this may be done through the use of question points.

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APPENDIX A.--TYPES OF PROJECTS FOR WHICH EIS'S MAY BE PREPARED AND FEDERAL
AGENCIES RESPONSIBLE FOR PREPARING THEM (22)

Agency Codes

AFS Forest Service.

BIA Bureau of Indian Affairs.
BLM Bureau of Land Management.
BOM Bureau of Mines.
BOR Bureau of Outdoor Recreation.

CGD Coast Guard.
COE Corps of Engineers.

EDA Economic Development Administration.
EPA Environmental Protection Agency

FAA Federal Aviation Administration.
FHW Federal Highway Administration.
FWS Fish and Wildlife Service

GSA General Services Administration.

HEW Department of Health, Education and Welfare.
HUD Department of Housing and Urban Development.

ICC Interstate Commerce Commission.
IGS Geological Survey.

LEA Law Enforcement Assistance Administration.

NPS National Park Service.

SCS Soil Conservation Service.

UMT Urban Mass Transportation Administration.
USN Department of Navy.

Types of Projects and Sponsoring Agencies

Extraction

Mineral exploration.....IGS
Mining.....AFS, BLM, BOM, FWS

Water supply, waste disposal, pollution control systems

Air pollution control (funding or grant).....EPA
Area waste-treatment plans (approval).....EPA
NPDES new source discharge (permit).....EPA
Research and monitoring (funding or grant).....EPA
Sanitary landfills.....USN
Sewage treatment and facilities.....AFS, HUD
Solid-waste management (funding or grant).....AFS
Wastewater management.....COE
Wastewater treatment works (grants).....EPA
Water supply (reservoirs).....COE

Water resource development

Beach erosion.....COE
Boat harbors (small boats).....COE
Dredge and fill (diked disposal).....COE, USN
Flood insurance.....HUD
Multipurpose impoundments.....COE
Navigation.....COE
Operation and maintenance of civil works water resources.....COE
Permits for works in navigable waters.....COE
Watershed protection and flood control.....SCS, COE

Transportation

Highways.....FHW, AFS
Mass transit.....UMT
Off-road vehicle use.....AFS
Railroads.....ICC
Rate increase on transportation of recyclables.....ICC

Land use

Boundary change.....NPS

Change in land use (extensive or incompatible with surrounding area).....EPA

Forestry.....AFS

Land acquisition or disposal.....BLM, AFS, USN, FWS, GSA

Land-use plans.....AFS, NPS, FWS

Land and water conservation funds.....BOR

National scenic trails.....BOR

Open-space land.....BOR, HUD

Parks, recreation areas, wilderness areas.....BOR, NPS, FWS

Reclaimed mined land and restoration.....BOM

Surplus property transfer.....BOR, HEW

Timber management.....AFS

Title X mortgage insurance for land development.....HUD

Wild and scenic rivers studies.....AFS, BOR

Wildlife refuges, fish hatcheries.....FWS

Winter sports areas.....AFS

Other

Code enforcement.....HUD

Construction (grants and facilities).....USN, HEW, FWS, LEA, CGD, FAA, GSA

Industry characterized as a major polluter.....EDA

Major actions affecting reservation Indians.....BIA

Regulations, policy and guidance documents.....HUD, EPA

Resource-management, development measures, conservation and
critical use.....SCS, NPS, LEA,
FWS, EDA, USN

APPENDIX B.--STATE CONTACTS¹ FOR INFORMATION REGARDING ENVIRONMENTAL IMPACT ASSESSMENT REQUIREMENTS AND MINING AND MINERAL LAND RECLAMATION LAWS

State	Environmental impact assessment requirements, ² contact	Mining and mined-land reclamation laws ³	
		Contact	Minerals regulated
Alabama.....	Office of the Director Alabama Environmental Health Administration Room 328 State Office Bldg. Montgomery, AL 36130 Tel: (205) 832-3176	Alabama Surface Mining Reclamation Commission Box 1027 Jasper, AL 33501 Tel: (205) 221-4130 Alabama Department of Industrial Relations 204 Industrial Relations Bldg. Montgomery, AL 36130 Tel: (205) 832-3628	Coal. All minerals except coal.
Alaska ⁴	Land Use Supervisor Division of Terrestrial Programs Alaska Department of Environmental Conservation Pouch O Juneau, AK 99811 Tel: (907) 465-2635	Attn: Pete Nelson Land Management Officer Division of Mineral and Energy Management Alaska Department of Natural Resources 323 East 4th Ave. Anchorage, AK 99510 Tel: (907) 274-8542 Attn: Ed Barber Land Management Officer Division of Land Alaska Department of Natural Resources 323 East 4th Ave. Anchorage, AK 99510 Tel: (907) 279-5577	Oil and gas, metals, coal. Sand, gravel, clay, other minerals for the con- struction industry.
Arizona ⁴	State Clearing House Office of Economic Plan- ning and Development 1700 West Washington St. Mail Room 505 Phoenix, AZ 85007 Tel: (602) 271-5004	Arizona State Land Department 1627 West Adams Phoenix, AZ 85007 Tel: (602) 271-4628	All minerals.

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined-land reclamation laws ³	
		Contact	Minerals regulated
Arkansas.....	Arkansas Public Service Commission State Capitol Bldg. Little Rock, AR 72201 Tel: (501) 371-2051	Arkansas Department of Pollution Control and Ecology 8001 National Dr. Little Rock, AR 72709 Tel: (501) 371-1701	All minerals.
California...	Secretary California Resource Agency Room 1311 1416 9th St. Sacramento, CA 95814 Tel: (916) 445-9134	State Mining and Geology Board ⁵ Division of Mines and Geology State Department of Conservation Room 1341 1416 9th St. Sacramento, CA 95814 Tel: (916) 445-1825	Do.
Colorado.....	Director Division of Planning State Department of Local Affairs Room 520 Centennial Bldg. 1313 Sherman St. Denver, CO 80203 Tel: (303) 892-2351	Division of Mined Land Reclamation State Department of Natural Resources Room 723 1313 Sherman St. Denver, CO 80203 Tel: (303) 892-3567	Do.
Connecticut..	Director Division of Planning and Coordination State Department of Environmental Protection State Office Bldg. 165 Capitol Ave. Hartford, CT 06115 Tel: (203) 566-4202	(⁶)	XX
Delaware.....	State Office of Management, Budget, and Planning Executive Department Townsend Bldg. Federal St. Dover, DE 19901 Tel: (302) 678-4271	(⁶)	XX

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined-land reclamation laws ³	
		Contact	Minerals regulated
District of Columbia.	Director Office of Environmental Planning Department of Environmental Services 415 12th St. NW. Washington, DC 20004 Tel: (202) 629-3105	Office of Environmental Planning Department of Environmental Services 415 12th St. NW. Washington, DC 20004 Tel: (202) 629-3105	All minerals.
Florida.....	Office of Environmental Services Florida Game and Fresh-water Fish Commission Bryant Bldg. 1620 South Meridian Tallahassee, FL 32304 Tel: (904) 488-6661	Bureau of Geology Florida Department of Natural Resources 903 West Tennessee St. Tallahassee, FL 32304 Tel: (904) 448-2479	Do.
Georgia.....	State Office of Planning and Budget 270 Washington St., SW. Atlanta, GA 30334 Tel: (404) 656-3861	Bureau of Land Reclamation Georgia Department of Natural Resources Box 233 Macon, GA 31201 Tel: (912) 744-3346	Do.
Hawaii ⁷	Director Office of Environmental Quality Control Office of the Governor Room 301 550 Halekauwila St. Honolulu, HI 96813 Tel: (808) 548-6915	Division of Water and Land Development State Department of Land and Natural Resources Box 373 Honolulu, HI 96809 Tel: (808) 548-7643	Do.
Idaho.....	Division of Environment Idaho Department of Health and Welfare State Offices--State House Boise, ID 83720 Tel: (208) 384-2393	Idaho Department of Lands State House Boise, ID 83727 Tel: (208) 384-3617	Do.

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined-land reclamation laws ³	
		Contact	Minerals regulated
Illinois.....	Director Illinois State Clearinghouse Governor's Bureau of Budget 3d Floor Lincoln Tower Plaza 524 South 2d St. Springfield, IL 62706 Tel: (217) 782-3105	Division of Land Reclamation Illinois Department of Mines and Minerals 704 State Office Bldg. Springfield, IL 62706 Tel: (217) 782-4970 Office of the Director Illinois Department of Mines and Minerals 704 State Office Bldg. Springfield, IL 62706 Tel: (217) 782-6719	All minerals mined at surface. All minerals mined underground.
Indiana.....	Coordinator of Environmental Programs Agency of the Indiana Board of Health 1330 West Michigan St. Indianapolis, IN 46206 Tel: (317) 633-8467	Division of Reclamation Indiana Department of Natural Resources 613 State Office 100 North Senate Indianapolis, IN 46204 Tel: (317) 633-6244	Coal, shale, clay.
Iowa.....	Iowa Department of Environmental Quality 3920 Delaware Ave. Box 3326 Des Moines, IA 50316	Division of Mines and Minerals Iowa Department of Soil Conservation Grimes State Office Bldg. Des Moines, IA 50319 Tel: (515) 281-5774	All minerals.
Kansas.....	Division of Environment State Department of Health and Environment State House Topeka, KS 66620 Tel: (913) 862-9360	Legal Department State Corporation Commission 4th Floor State Office Bldg. Topeka, KS 66612 Tel: (913) 296-3361	Coal.

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined-land reclamation laws ³	
		Contact	Minerals regulated
Kentucky.....	Office of Planning and Research Secretary's Office of the State Department of Natural Resources and Environmental Protection 6th Floor Capitol Plaza Tower Frankfort, KY 40601 Tel: (502) 564-7320	Division of Reclamation State Department of Natural Resources and Environmental Protection 6th Floor Capitol Plaza Tower Frankfort, KY 40601 Tel: (502) 564-6940	All minerals.
Louisiana....	Director Office of Wetlands State Wildlife and Fisheries Department 400 Royal St. New Orleans, LA 70130 Tel: (504) 568-5665	Division of Oil and Gas State Department of Conservation Box 44275 Baton Rouge, LA 70804 Tel: (504) 389-5161	Coal.
Maine.....	Commissioner State Department of Environmental Protection State House Augusta, ME 04333 Tel: (207) 289-2811	Bureau of Land Quality State Department of Environmental Protection State House Augusta, ME 04333 Tel: (207) 289-2111	All minerals.
Maryland.....	Clearinghouse Department of State Planning 301 West Preston St. Baltimore, MD 21201 Tel: (301) 383-2467	Tower Plant and Siting Administration Maryland Department of Natural Resources Tawes State Office Bldg. Annapolis, MD 21401 Tel: (301) 269-2261	Do.
Massachusetts	Massachusetts Environmental Policy Act Executive Office of Environmental Affairs 100 Cambridge St. Boston, MA 02220 Tel: (617) 727-5830	(⁶)	XX

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined-land reclamation laws ³	
		Contact	Minerals regulated
Michigan.....	Environmental Review Board Bureau of Special Boards and Commissions Michigan Department of Management and Budget 1st Floor Stevens T. Mason Bldg. Box 30026 Lansing, MI 48909 Tel: (517) 373-6491	Division of Geology Michigan Department of Natural Resources Stevens T. Mason Bldg. Box 30028 Lansing, MI 48909 Tel: (517) 373-1256	All surface-mined minerals except sand, marl, gravel, peat, and clay.
Minnesota....	Director for Environmental Planning State Planning Agency Capitol Square 550 Cedar St. St. Paul, MN 55101 Tel: (612) 296-8254	Division of Minerals Minnesota Department of Natural Resources 345 Centennial Bldg. St. Paul, MN 55155 Tel: (612) 296-4807	Metallic minerals.
Mississippi..	Project Review Manager Office of the Governor Box 139 Jackson, MS 39205 Tel: (601) 354-7787	Mississippi Geologic, Economic, and Topographic Survey Box 4915 Jackson, MS 39216 Tel: (601) 354-6228	All minerals.
		State Oil and Gas Board Box 1332 Jackson, MS 39205 Tel: (601) 354-7104	Oil and gas.
Missouri.....	Division of Budget and Planning Office of Administration Room B-9 Capitol Bldg. Box 509 Jefferson City, MO 65101 Tel: (314) 751-3925	Land Reclamation Commission Division of Environmental Quality Missouri Department of Natural Resources Box 1368 Jefferson City, MO 65101 Tel: (314) 751-3241	All minerals.

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined-land reclamation laws ³	
		Contact	Minerals regulated
Montana.....	Executive Director Environmental Quality Council Capitol Station Box 215 Helena, MT 59601 Tel: (406) 449-3742	Montana Department of State Lands Capitol Station Helena, MT 59601 Tel: (406) 449-2074	All minerals.
Nebraska.....	Comprehensive Planning Coordinator Office of Planning and Programing Box 94601 State Capitol Lincoln, NE 68509 Tel: (402) 471-2414	(⁶)	XX
Nevada.....	Division of Environmental Protection Nevada Department of Conservation of Natural Resources 201 South Fall Carson City, NV 89710 Tel: (702) 885-4670	(⁶)	XX
New Hampshire	Office of Comprehensive Planning Office of the Governor State House Annex Concord, NH 03301 Tel: (603) 271-2155	Division of Forests and Lands State Department of Natural Resources Box 856 State House Annex Concord, NH 03301 Tel: (603) 271-2214	All minerals.
New Jersey...	Office of Environmental Review State Department of Environmental Protection Box 139 Trenton, NJ 08625 Tel: (609) 292-2662	(⁶)	XX

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined land reclamation laws ³	
		Contact	Minerals regulated
New Mexico...	State Planning Officer State Planning Office 505 Don Gaspar Greer Bldg. Santa Fe, NM 87502 Tel: (505) 827-2073	New Mexico Surface Coal Mining Commission c/o New Mexico Bureau of Mines and Mineral Resources Campus Station Socorro, NM 87801 Tel: (505) 835-5420	Coal.
New York.....	Director, Division of Environmental Analysis New York Department of Environmental Conservation Room 414 50 Wolf Rd. Albany, NY 12233 Tel: (518) 475-2233	Bureau of Mineral Resources New York State Environ- mental Commission Room 404A 50 Wolf Rd. Albany, NY 12233 Tel: (518) 457-7480	All minerals and mined topsoil.
North Carolina.	Division of Environmental Assessment State Department of Natu- ral Resources and Com- munity Development Box 27687 Raleigh, NC 27611 Tel: (919) 733-2955	Land Quality Section State Department of Natural and Economic Resources Box 27687 Raleigh, NC 27611 Tel: (919) 733-4574	All minerals.
North Dakota.	Division of Water Supply and Pollution Control North Dakota Department of Health 1200 Missouri Ave. Missouri Office Bldg. Bismarck, ND 58505 Tel: (701) 224-2386	Division of Reclamation and Siting State Public Service Commission State Capitol Bldg. Bismarck, ND 58505 Tel: (701) 224-2400	Do.

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined land reclamation laws ³	
		Contact	Minerals regulated
Ohio.....	Division of Environmental Assessment Office of Planning Coordination Ohio Environmental Protection Agency 361 Broad St. Columbus, OH 43215	Division of Reclamation Ohio Department of Natural Resources Fountain Square Columbus, OH 43224 Tel: (614) 466-4850 Division of Mines Ohio Department of Industrial Relations Box 825 2323 West 5th Ave. Columbus, OH 43216 Tel: (614) 466-4240	All surface-mined minerals. All underground-mined minerals.
Oklahoma.....	State, Oklahoma Department of Economic and Community Affairs 5500 North Western Oklahoma City, OK 73118 Tel: (405) 840-2811	Oklahoma Department of Mines and Mining 117 Capitol Bldg. Oklahoma City, OK 73105 Tel: (405) 521-3859	All minerals.
Oregon.....	Assistant to the Governor for Natural Resources Office of the Governor Room 160 State Capitol Bldg. Salem, OR 97310 Tel: (503) 378-3109	Division of Mined Land Reclamation Department of Geology and Mineral Industry Box 1028 Albany, OR 97231 Tel: (503) 928-2386	Do.
Pennsylvania.	Chief of the Division of Policy Planning and Project Revision Bureau of Environmental Planning State Department of Environmental Resources Room 813 Executive Office Bldg. 2nd St. and Chestnut Harrisburg, PA 17120 Tel: (717) 783-1334	Bureau of Surface Mine Reclamation State Department of Environmental Resources 7th Floor Fulton Bldg. Harrisburg, PA 17120 Tel: (717) 787-5103	Do.

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined land reclamation laws ³	
		Contact	Minerals regulated
Rhode Island.	Statewide Planning Program State Department of Administration 265 Melrose St. Providence, RI 02907 Tel: (401) 277-2656	(⁶)	XX
South Carolina.	Grants and Contracts Review Unit State Auditor's Office Box 11333 Room 214 Wade Hampton Office Bldg. Columbia, SC 29211 Tel: (803) 758-3160	Land Resources Conservation Commission State Department of Mining Reclamation Box 11708 Columbia, SC 29211 Tel: (803) 758-2823	All minerals.
South Dakota.	South Dakota Department of Environmental Protection Room 406 Foss Bldg. Pierre, SD 57501 Tel: (605) 224-3351	State Conservation Commission South Dakota Department of Agriculture Room 322 Sigurd Andersen Bldg. Pierre, SD 57071 Tel: (605) 224-3258	Do.
Tennessee....	Office of Urban and Federal Affairs Tennessee Office of the Governor 108 Parkway Tower Nashville, TN 37219 Tel: (615) 741-2714	Division of Surface Mining State Department of Conservation 2611 West End Ave. Nashville, TN 37203 Tel: (615) 741-1046	Coal, clay and shale, barite, copper, phosphate, sand and gravel.
Texas.....	Director Budget and Planning Office Office of the Governor 411 West 13th St. Austin, TX 78704 Tel: (512) 475-2427	Surface Mining Reclamation Division Railroad Commission of Texas Box 12966 Austin, TX 78711 Tel: (512) 475-4252 Water Quality Board of Texas Stephen F. Austin Bldg. Austin, TX 78711 Tel: (512) 475-4252	Coal, lignite, uranium. Minerals mined in situ.

See footnotes at end of table.

State	Environmental impact assessment requirements, ² contact	Mining and mined land reclamation laws ³	
		Contact	Minerals regulated
Utah.....	Environmental Coordinator State Planning Office Room 118 State Capitol Bldg. Salt Lake City, UT 84114 Tel: (801) 533-5245	Division of Oil, Gas, and Mining Utah Department of Natural Resources 1588 West North Temple Salt Lake City, UT 84116 Tel: (801) 533-5771	All minerals except sand and gravel.
Vermont.....	State Environmental Board Agency of Environmental Conservation State Office Bldg. Montpelier, VT 05602 Tel: (802) 828-3309	State Environmental Board ³ Agency of Environmental Conservation State Office Bldg. Montpelier, VT 05602 Tel: (802) 828-3309	All minerals.
Virginia.....	Environmental Impact Coordinator Council on the Environment Room 903 9th St. Office Bldg. Richmond, VA 23219 Tel: (804) 786-4500	Division of Mined Land Reclamation Virginia Department of Conservation and Eco- nomic Development Drawer U Bigstone Gap, VA 24219 Tel: (703) 523-2925	Do.
Washington...	Washington Department of Ecology St. Martin's College Olympia, WA 98504 Tel: (206) 753-6890	Division of Geology and Earth Resources Washington Department of Natural Resources Olympia, WA 98504 Tel: (206) 753-6183	All minerals.
West Virginia	Division of Research and Statistics West Virginia Department of Natural Resources 1800 Washington St. East Charleston, WV 25305 Tel: (304) 348-2754	Reclamation Division West Virginia Depart- ment of Natural Resources Room 322 1800 Washington St. East Charleston, WV 25305	Do.

See footnotes at end of table.

State	Environmental impact assessment requirements, contact ²	Mining and mined land reclamation laws ³	
		Contact	Minerals regulated
Wisconsin....	Bureau of Environmental Impact Department of Natural Resources Box 7921 Madison, WI 53701 Tel: (608) 266-2121	Mine Reclamation Section Bureau of Water Regulation and Zoning Wisconsin Department of Natural Resources Box 7921 Madison, WI 53707 Tel: (608) 266-2050	All metallic minerals.
Wyoming.....	State Planning Coordinator's Office Office of the Governor 2320 Capitol Ave. Cheyenne, WY 82002 Tel: (307) 777-7574	Division of Land Quality Wyoming Department of Environmental Quality Hathaway Bldg. Cheyenne, WY 82002 Tel: (307) 777-7756	All minerals.

XX Not applicable.

¹ These State contacts do not preclude the importance of contacting Federal agencies when Federal lands are involved, or contacting local eschelons of government whose statutes may greatly affect mining operations.

² Modified from reference 3.

³ Modified from reference 10.

⁴ State reclamation requirements are established on a case-by-case basis to be included in the terms set to lease State lands for mining.

⁵ The Board oversees the policy, whereas the city or county that has principal responsibility for approving the mining permits that allow a minimal extraction activity to commence also has the responsibility to oversee and regulate the reclamation procedures of that surface mining operation.

⁶ The State has not legislated authority to regulate reclamation procedures; however, local governmental authorities at the city or township level may regulate and enforce reclamation practices through varying degrees of zoning ordinances and other land-use controls.

⁷ The State has no broad, statewide policy which oversees mined-land reclamation; reclamation is generally regulated by county authority. In cases where mining occurs on State-owned land, the State would delegate reclamation responsibilities.

⁸ The Board acts as an appeals board and to coordinate environmental regulation throughout the State's Environmental Districts. Vermont's Land Use and Development Laws establish regional administration, eight District Environmental Commissions and, respectively, eight district coordinators, to review and enforce land-use policies, including reclamation, within their districts. The State Environmental Board is not a first contact with respect to public matters; they coordinate the eight other first contacts

APPENDIX C.--ENVIRONMENTAL INVENTORY FACTORS (24)

I. Earth science factors

- A. Climatology and meteorology: (1) Precipitation; (2) temperature; (3) wind; (4) storms.
- B. Geology: (1) Lithology; (2) stratigraphy; (3) structure; (4) mineral resources; (5) engineering characteristics of rock types.
- C. Physiography: (1) Slopes; (2) elevations-depressions.
- D. Hydrology: (1) Drainage areas; (2) stream discharge; (3) water tables; (4) ground-water yields and quality.
- E. Pedology: (1) Permeability; (2) porosity; (3) stability; (4) erodability; (5) utilization.

II. Ecological factors

- A. Ecosystem: (1) Structure (species density, diversity, dominance, successional stages; standing crops); (2) population-induced changes in system (pollution, removal of individuals or species, nonindigenous species present).
- B. Unusual qualities: (1) Unique or rare ecosystems; (2) endangered species; (3) scenic values.
- C. Economic values: (1) Forestry (productivity, marketable species); (2) recreation (hunting, fishing, boating); (3) agriculture (crops, livestock); (4) special problems (drainage, flooding, slope, soils); (5) dollar value of land; (6) commercial fishing.

III. Water quality factors

- A. Data sources and data: (1) State water survey; (2) reservoir suitability of land data; (3) surface water resources data; (4) waste water treatment data; (5) water quality studies--case records.
- B. Water quality legislation and regulations: (1) Federal Government; (2) State and local governments.
- C. Water quality: (1) Chlorides; (2) sulfates; (3) nitrates; (4) phosphates; (5) oil; (6) pH; (7) Chemical Oxygen Demand; (8) dissolved O₂; (9) dissolved solids; (10) temperature; (11) turbidity; (12) conductivity; (13) hardness; (14) suspended solids; (15) biota; (16) Biological Oxygen Demand (BOD).
- D. Source of water pollution: (1) Runoff; (2) industry; (3) sewage effluents; (4) soil erosion; (5) salt; (6) storm sewers; (7) fertilizers and insecticides; (8) thermal emissions.
- E. Flood control.
- F. Precipitation.

IV. Air quality factors

- A. Data sources and data: (1) Wind and stability records; (2) traffic data and records; (3) pollution concentration--location records; (4) measuring equipment and equipment catalogs; (5) air quality studies--case records; (6) emission source information.
- B. Air quality legislation and regulations: (1) Federal Government; (2) State and local governments.
- C. Effects of air pollution: (1) Effects on people and their health; (2) effects on plants; (3) biological and biographical cycles; (4) effects on visibility; (5) effects on materials and economy; (6) effects on other facilities or activities (by case file).
- D. Air pollution control: (1) See item IV--B; (2) vehicle emission-control equipment; (3) industrial emission-control equipment; (4) control through land use, zoning, or regulations; (5) natural ventilation by atmospheric process; (6) weather modification.

V. Social science factors

- A. Relocations: (1) Effect on individuals (social class, age); (2) effect on families (psychological, social, and economic impact); (3) effect on communities (services, cohesion, civil disorders).
- B. Community growth: (1) Population growth; (2) economic growth (social aspects); (3) growth desirability (plan; community, family and individual attitudes; adaptation of local resources).
- C. Community values: (1) maintenance of community cohesion; (2) community power organizations (unions, political groups); (3) public information networks; (4) transportation network; (5) feelings towards transition; (6) quality of life (pollution impact, family and individual lifestyle); (7) effect on property value; (8) adjacent land-use harmony; (9) safety.
- D. Public facilities (access, availability): (1) Health care (hospitals, clinics, nursing homes); (2) education (public, private schools; colleges; trade schools); (3) police and fire protection; (4) public transportation facilities; (5) religious; (6) recreational.
- E. Employment effects: (1) Commercial, industrial growth; (2) expanded geographical employment region; (3) local labor force change in size; (4) competition for existing jobs; (5) increased opportunities.
- F. Effects on special groups: (1) ethnic; (2) elderly; (3) handicapped; (4) poor; (5) young; (6) institutionalized populations.

VI. Economic factors

- A. Relocation costs--immediate and long-range: (1) Individuals; (2) families; (3) business; (4) general community.
- B. Community economic growth: (1) Current commercial trade; (2) changes in community economic mode; (3) employment projection.
- C. Taxes: (1) Base loss due to public allocation; (2) base gains due to rezoning; (3) base changes due to land-value fluctuations.
- D. Property values (individual).
- E. Impact on economic resources.
- F. Employment effects.

VII. Historical factors

- A. Description of type of property: (1) Size; (2) type of structures.
- B. Description of significance: (1) Local; (2) State; (3) national.
- C. Particular sensitivity problems associated with project: (1) visual; (2) audio; (3) atmospheric.
- D. Inclusion in National Register of Historic Places: (1) Inclusion at present; (2) desirability to include, if not at present.

APPENDIX D.--EXCERPTS FROM REFERENCE 13 CONCERNING EFFECT
OF LOCAL ZONING ORDINANCES ON MINING IN MICHIGAN

In response to numerous inquiries from various governmental bodies, private industry, and the general public concerning local regulation of mining, the U.S. Bureau of Mines Liaison Office in Lansing, Mich., conducted a study of local zoning ordinances to determine their effects on mining in Michigan. The study revealed that, of a total of 1,245 townships in Michigan, 1,047 have zoning ordinances at either the township or county level. About 16 percent, or 198 townships, remain unzoned. A few of these, however, indicated that they are planning to initiate such an ordinance. Several others indicated they are considering revision of their present zoning ordinances.

The results suggest that the zoning ordinance is a primary tool to regulate mining operations, including the removal of sand and gravel. Generally, local ordinances exist to prevent nuisance situations and to protect the health, safety, and general welfare of the citizens of the township. However, a review of zoning ordinances adopted during the past few years also indicates a trend towards regulations that provide mineral reservation or conservation and assure reclamation or restoration of the mining site.

During the study, actual zoning ordinances from 260 townships with local zoning and county ordinances covering an additional 288 townships were reviewed. Table D-1, based on these 548 townships accounting for 44 percent of the townships in Michigan, indicates a variety of regulations in the State.

TABLE D-1. - Types of regulations for Michigan townships and counties

Type of regulation	Townships	Counties
Mining ordinance or mineral district.....	62	27
Permit system:		
Special or conditional use.....	118	165
Mining permit.....	52	48
Grading permit.....	3	11
Mine or operation plan.....	99	11
Reclamation or restoration plan.....	58	47
Pollution controls:		
Air.....	39	59
Noise.....	30	55
Water.....	62	75
Blasting regulations.....	12	28
Bonding.....	94	79
Fencing or screening.....	73	49
Setbacks.....	83	71
Miscellaneous restrictions.....	159	171

One of the most common types of regulations affecting mining at the township or county level is the permit system. Seventy-two percent of the townships reported some type of a permit system, whether a mining permit, conditional or special-use permit, or a grading permit. Requirements for permit applications vary with each community; however, both mining permits and

conditional-use permits usually require the same general information. Information requested in an application includes the following:

1. Name and address of applicant.
2. Legal description of land involved.
3. Legal interest in property and name of property owner.
4. Type and estimated amount of material to be removed.
5. Measures to be taken by applicant to control noise, vibration, dust, and traffic.
6. A description of any traffic control devices, public facilities, or public services which will be required and a statement as to how the costs will be paid.
7. Measures proposed by the applicant to insure public safety, exclusion of children from the property, and the lateral support of surrounding land and structures.
8. The time required to complete the proposed operation.
9. A detailed description, by maps or otherwise, of the intended operation.

APPENDIX E.--EXAMPLE OF A REDUCED INFORMATION MATRIX FOR ENVIRONMENTAL IMPACT ASSESSMENT

A reduced information matrix is the environmental picture of a specific operation (fig. E-1). It shows (1) actions that change elements of the environment, (2) the magnitudes of the impacts of change, and (3) the relative importance of the impact. In figure E-1, the parameters being quantified are magnitude of impact and importance of impact. Magnitude of impact refers to the severity, extent, or degree of impact that an action may exert upon an element of the environment. Importance of impact refers to the degree of injury including aesthetic, as assessed in human values, caused by the operation. It describes the priority which ought to be given to preserve the integrity of the environmental element altered as a result of the mining activity. The following steps may be taken to develop the reduced matrix:

- a. Identify all elements of the operation that may cause any environmental impact. These should appear as column headings.
- b. Identify all elements of the environment which are potential targets of impact. These should appear as row headings.

		Elements that may cause environmental impact									
Elements of the environment		Industrial site and buildings	Blasting	Stockpiling of crushed stone	Rock haulage	Mineral processing	Surface excavation	Transportation	Landscaping	Roads and bridges	Transmission lines
	Erosion						3	1		3	3
	Soils						2	2	4	2	2
	Water quality			3	2	1	2	2			
	Air quality		6	3	2	2	2	2	2		
	Wildlife		3	2	1	1	1	2	2	1	1
	Wilderness quality	5	6	5	4	3	4	3	5	4	5
	Recreation and cultural activities	3	5	4	4	2	3	4	5	4	
	Noise		7	10	3	2	2	3	4		
	Health and safety		5	8			2	3	4		
	Topography						4	2			
	Vegetation	3	1	3	1		3	1			

c. Once a grid of rows and columns is set, place a slash in each box formed by the intersection of an element of the operation and an element of the environment for which there is impact.

d. A reduced matrix is drawn from the general matrix, completed by the first three steps of this guide, by eliminating those elements for which no slash was issued in step c. This smaller matrix should not overlook the scope of the general matrix.

e. Place a number from 1 to 10 in the upper left corner of each slashed box. The ranking should be thought of as linear (even increments between numbers). The numerical value in this corner represents the magnitude of the possible impact of the action upon the

Example:

4	8
---	---

 4 = Magnitude of impact
8 = Importance of impact

FIGURE E-1. - Reduced matrix of a stone quarry operation--an example (modified from reference 11).

element of the environment; 10 represents the greatest magnitude and 1 represents the least.

f. Place a number for the degree of importance in the lower right corner of each slashed box. Use a 1-to-10 scale similar to that used in step e.

g. Text explaining the criteria used in determining each matrix value should accompany the completed matrix to persons examining the matrix at a later time to subjectively evaluate the impacts on their own matrices.

APPENDIX F.--ENVIRONMENTAL LOGIC ASSOCIATED WITH SITE SELECTION

Figures F-1 and F-2 should serve as a useful guide to site selection.

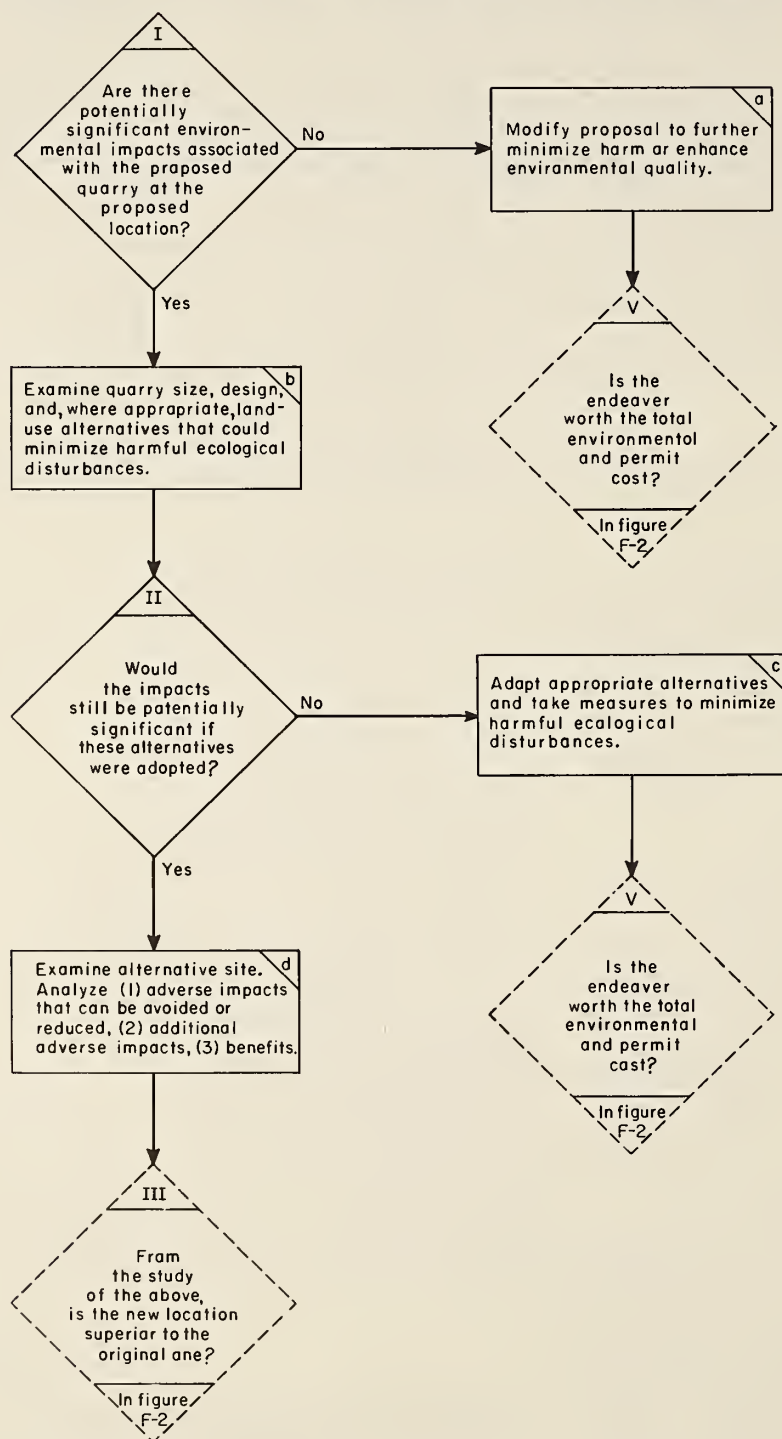


FIGURE F-1. - Environmental logic associated with site selection (part 1).

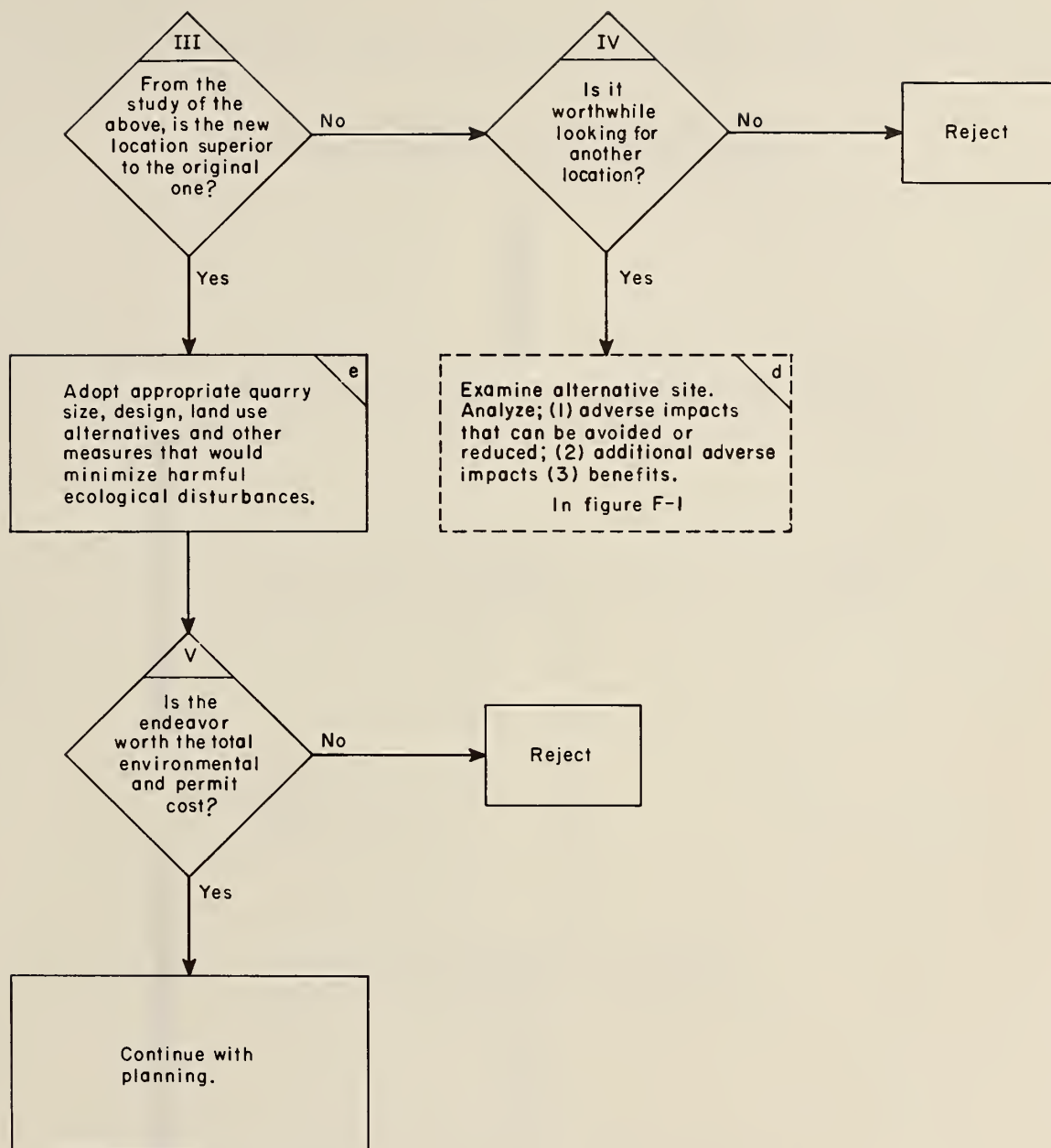


FIGURE F-2. - Environmental logic associated with site selection (part 2).

APPENDIX G.--FLOW CHART THAT URBAN GOVERNMENT MAY USE
FOR ENFORCING POLLUTION CONTROL LAWS

Referring to figure G-1, the path of least resistance (filled arrow) is traveled when citizens' complaints and legal actions are minimized.

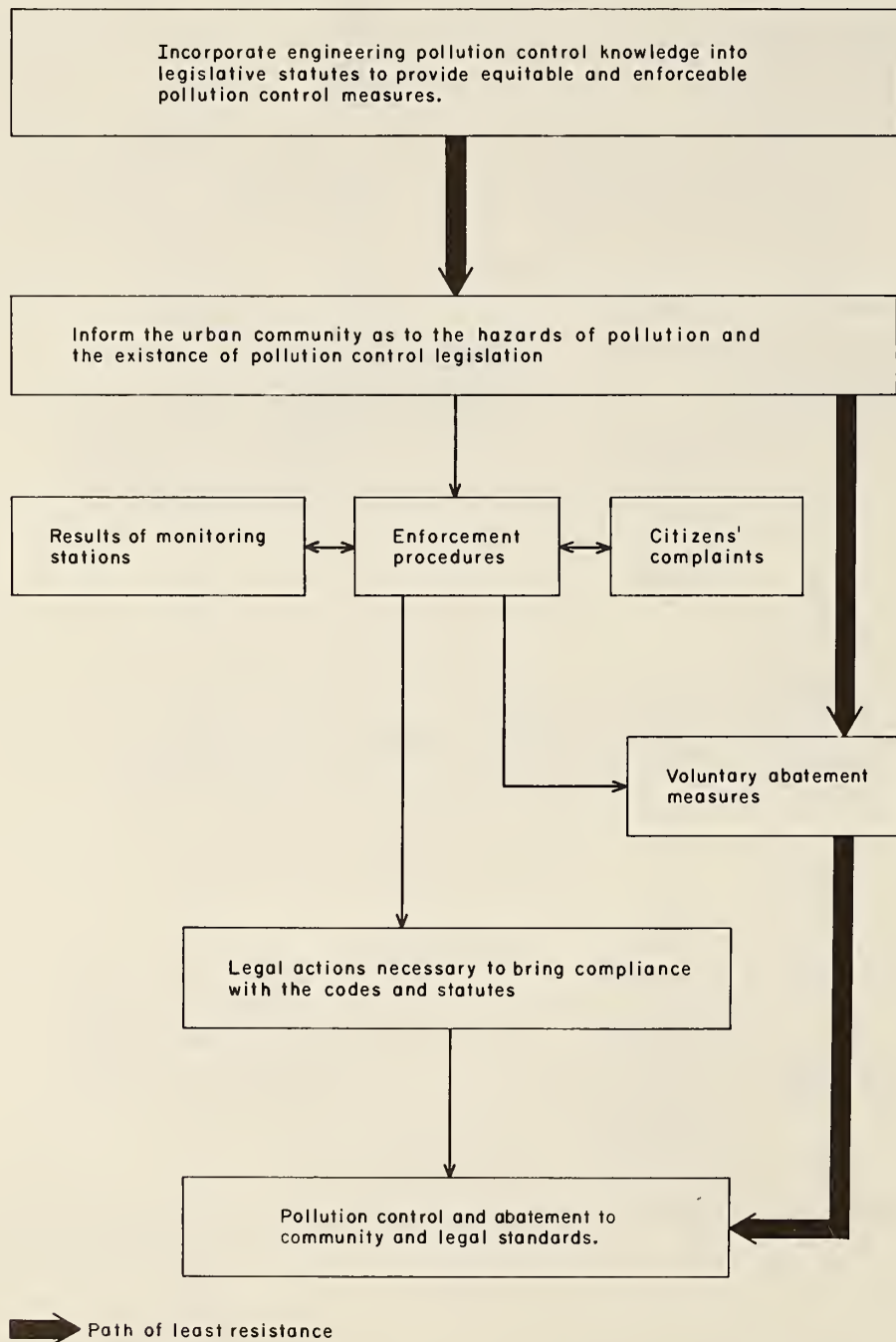
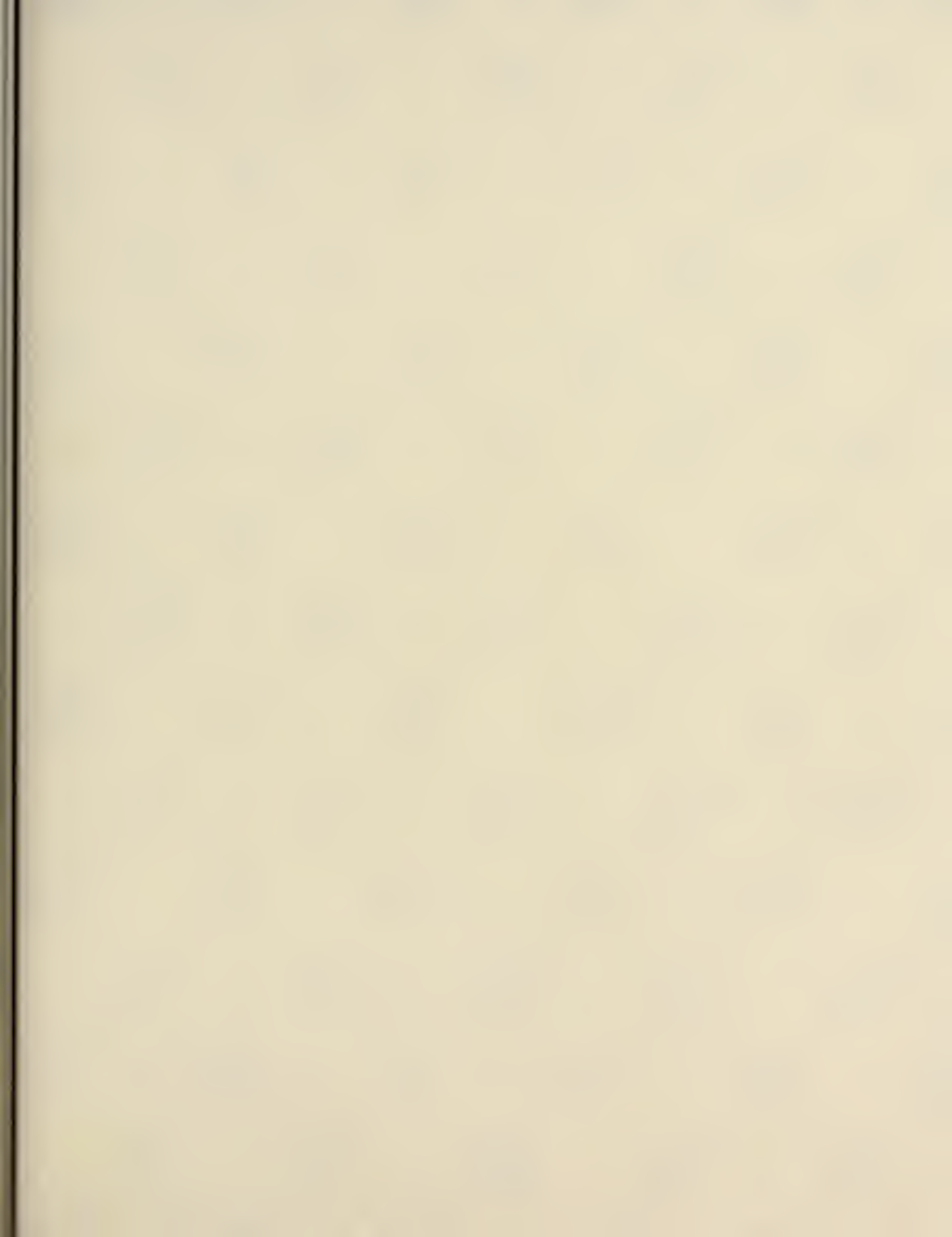


FIGURE G-1. - Generalized flow chart that urban government may use for enforcing pollution control laws (modified from reference 9).









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